

In re Patent Application of:

RAYNOR

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an array of pixels and a corresponding array of microlenses disposed adjacent said array of pixels, positions of said microlenses relative to corresponding pixels varying based upon distances of said corresponding pixels from a central optical axis of the solid state image sensor to substantially eliminate vignetting of light collected by said microlenses;

said array of microlenses being divided into blocks each comprising a plurality of said microlenses, and within at least one of said blocks the positions of said microlenses relative to said corresponding pixels thereof being varied by an equal amount.

12. The solid state image sensor of Claim 11 wherein said microlenses within each of said blocks are substantially equally spaced apart from one another a first distance, and wherein adjacent blocks of microlenses are spaced apart from one another a second distance less than the first distance.

13. The solid state image sensor of Claim 11 wherein said microlenses are substantially equally spaced from one another throughout said array of microlenses, and wherein a plurality of microlenses in each of said blocks at edges thereof are smaller in at least one dimension than said remaining microlenses in each of said blocks.

14. The solid state image sensor of Claim 11 wherein said blocks are substantially rectangular.

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15. The solid state image sensor of Claim 11 wherein said blocks have irregular edges, and wherein said blocks are tessellated to form a substantially continuous array of microlenses.

16. A solid state image sensor comprising:

an array of pixels;

T said array of pixels having a first aspect ratio and each of said pixels including a light-sensitive area having a second aspect ratio;

 said first aspect ratio being substantially equal to said second aspect ratio.

17. The solid state image sensor of Claim 16 further comprising a corresponding array of microlenses disposed adjacent said array of pixels.

18. The solid state image sensor of Claim 17 wherein positions of said microlenses relative to corresponding pixels vary based upon distances of said corresponding pixels from a central optical axis of the solid state image sensor to substantially eliminate vignetting of light collected by the microlenses.

19. The solid state image sensor of Claim 18 wherein said array of microlenses is divided into blocks each comprising a plurality of said microlenses, and within at least one of said blocks the positions of said microlenses

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relative to said corresponding pixels thereof are varied by an equal amount.

20. An imaging system comprising:

a solid state image sensor comprising

an array of pixels and a corresponding array of microlenses disposed adjacent said array of pixels, positions of said microlenses relative to corresponding pixels *varying* based upon distances of said corresponding pixels from a central optical axis of said solid state image sensor to substantially eliminate vignetting of light collected by said microlenses,

said array of microlenses being divided into blocks each comprising a plurality of said microlenses, and within at least one of said blocks the positions of said microlenses relative to said corresponding pixels thereof being varied by an equal amount; and

a display for cooperating with said solid state image sensor to display images therefrom.

21. The imaging system of Claim 20 wherein said microlenses within each of said blocks are substantially equally spaced apart from one another a first distance, and wherein adjacent blocks of microlenses are spaced apart from one another a second distance less than the first distance.

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22. The imaging system of Claim 20 wherein said microlenses are substantially equally spaced from one another throughout said array of microlenses, and wherein a plurality of microlenses in each of said blocks at edges thereof are smaller in at least one dimension than said remaining microlenses in each of said blocks.

23. The imaging system of Claim 20 wherein said blocks are substantially rectangular.

24. The imaging system of Claim 20 wherein said block have irregular edges, and wherein said blocks are tessellated to form a substantially continuous array of microlenses.

IV

25. An imaging system comprising:
a solid state image sensor comprising an array of pixels, said array of pixels having a first aspect ratio and each of said pixels including a light-sensitive area having a second aspect ratio, and said first aspect ratio being substantially equal to said second aspect ratio; and
a display for cooperating with said solid state image sensor to display images therefrom.

26. The imaging systems of Claim 25 further comprising a corresponding array of microlenses disposed adjacent of said array of pixels.

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27. The imaging systems of Claim 26 wherein positions of said microlenses relative to corresponding pixels vary based upon distances of said corresponding pixels from a central optical axis of said solid state image sensor to substantially eliminate vignetting of light collected by the microlenses.

28. The imaging systems of Claim 27 wherein said array of microlenses is divided into blocks each comprising a plurality of said microlenses, and within at least one of said blocks the positions of said microlenses relative to said corresponding pixels thereof are varied by an equal amount.

29. A camera comprising:
a housing; and
a solid state image sensor carried by said housing
and comprising

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an array of pixels and a corresponding array of microlenses disposed adjacent said array of pixels, positions of said microlenses relative to corresponding pixels varying based upon distances of said corresponding pixels from a central optical axis of said solid state image sensor to substantially eliminate vignetting of light collected by said microlenses,

said array of microlenses being divided into blocks each comprising a plurality of said microlenses, and within at least one of said blocks the positions of said microlenses relative to said

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corresponding pixels thereof being varied by an equal amount.

30. The camera of Claim 29 wherein said microlenses within each of said blocks are substantially equally spaced apart from one another a first distance, and wherein adjacent blocks of microlenses are spaced apart from one another a second distance less than the first distance.

31. The camera of Claim 29 wherein said microlenses are substantially equally spaced from one another throughout said array of microlenses, and wherein a plurality of microlenses in each of said blocks at edges thereof are smaller in at least one dimension than said remaining microlenses in each of said blocks.

32. The camera of Claim 29 wherein said blocks are substantially rectangular.

33. The camera of Claim 29 wherein said blocks have irregular edges, and wherein said blocks are tessellated to form a substantially continuous array of microlenses.

II

34. A camera comprising:
a housing; and
a solid state image sensor carried by said housing and comprising an array of pixels, said array of pixels having a first aspect ratio and each of said pixels including a light-sensitive area having a second aspect ratio, and said

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first aspect ratio being substantially equal to said second aspect ratio.

35. The camera of Claim 34 further comprising a corresponding array of microlenses disposed adjacent said array of pixels.

36. The camera of Claim 35 wherein positions of said microlenses relative to corresponding pixels vary based upon distances of said corresponding pixels from a central optical axis of said solid state image sensor to substantially eliminate vignetting of light collected by the microlenses.

37. The camera of Claim 36 wherein said array of microlenses is divided into blocks each comprising a plurality of said microlenses, and within at least one of said blocks the positions of said microlenses relative to said corresponding pixels thereof are varied by an equal amount.

38. A method for substantially eliminating vignetting of light collected by microlenses disposed adjacent an array of pixels in a solid state image sensor, the method comprising:

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varying positions of the microlenses relative to corresponding pixels based upon distances of the corresponding pixels from a central optical axis of the solid state image sensor;

dividing the microlenses into a plurality of blocks of microlenses; and

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varying positions of a plurality of microlenses within at least one of the blocks of microlenses relative to corresponding pixels thereof by an equal amount.

39. The method of Claim 38 wherein the microlenses within each of the blocks are substantially equally spaced apart from one another a first distance, and wherein adjacent blocks of microlenses are spaced apart from one another a second distance less than the first distance.

40. The method of Claim 38 wherein the microlenses are substantially equally spaced from one another throughout the array of microlenses, and wherein a plurality of microlenses in each of the blocks at edges thereof are smaller in at least one dimension than the remaining microlenses in each of the blocks.

41. A method for making a solid state image sensor comprising:

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forming an array of pixels so that the array has a first aspect ratio, each of the pixels including a light-sensitive area having a second aspect ratio, and the first aspect ratio being substantially equal to the second aspect ratio.

42. The method of Claim 41 further comprising disposing a corresponding array of microlenses adjacent the array of pixels.